Astrometric Observation Techniques

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South Africa Workshop

2014 March 10

Hardware Concerns

- Shutter timing

  accurate clock isn't enough

- Pixel size

  Nyquist sampling of seeing disk for highest accuracy
  but a pixel 60% of seeing disk may improve detectability

- Filter choice

  work unfiltered for greatest depth
  may be fringing issues; consider high-pass filter
  low altitude sites will suffer from dispersion the most
  report the bandpass of the reference source, not the filter!

Binning by 1, 2, 3, 4, 6, 9

Reference Catalog

- UCAC4

  very accurate, all-sky, but shallow

- USNO-B1.0

  deep, all-sky, but biased with lots of bogus doubles
  mediocre photometry (B and R bands)

- 2MASS

  very accurate, moderately dense, but no proper motions
  good photometry (infrared JHK bands)

- PPMXL

  merger of USNO-B1.0, 2MASS, PPMX
  deep, all-sky, less biased, still has bogus doubles

Reference Catalog, continued

- SDSS

  not all-sky (haven't used it, so no experience)

- Pan-STARRS

  not all-sky, not yet public, 2MASS-based at the moment

- Gaia

  first release maybe two years from now?
  highest accuracy, comparable depth to USNO-B / PPMXL
  all-sky, good photometry, good proper motions
  The Holy Grail

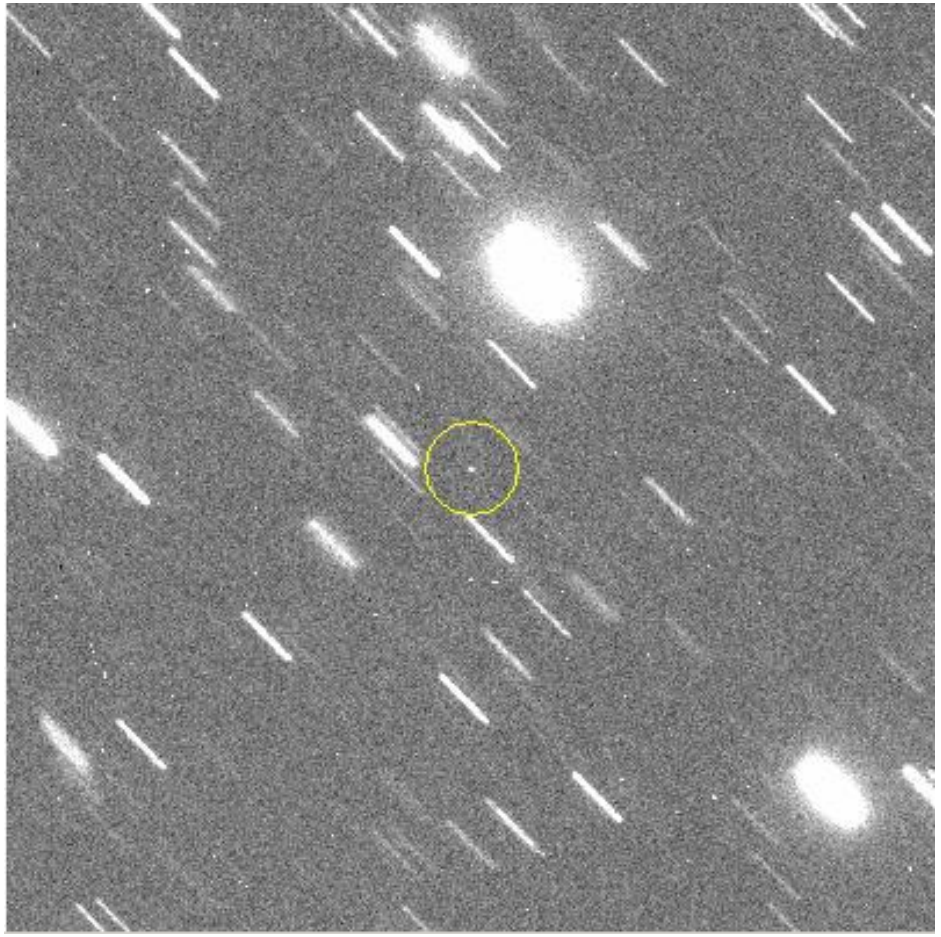
Software Concerns

- Herbert Raab's *Astrometrica*
  - can find moving objects for you
  - can identify known objects for you
  - prepares MPC reports
  - can't handle trailed images
- Bob Denny's *PinPoint*
  - highly automated
- Custom software
  - lets you do whatever you want
  - expensive

Observing Techniques

- Develop an exposure time calculator
  - every 0.38 mag fainter doubles exposure
  - doubling the SNR requires 4 times the exposure
  - half the seeing doubles the SNR (sky limited)
- Aim for SNR of 5-10
  - anything less leads to questionable detections
  - law of diminishing returns for more
- Remember, asteroids vary in brightness!
  - rotational lightcurve
  - orbital lightcurve
  - eclipse events in binaries
  - poorly known phase function
  - errors in the absolute magnitudes

Observing Techniques, continued



Non-sidereal tracking or autoguiding makes it easier to reach fainter magnitudes. Stacking of many short exposures can achieve a similar effect at the expense of multiple readouts, but exposure times need to be limited to however long it takes the object to move a seeing disk.

Questions?